revascularization. Twenty-two patients with contractile dysfunction (LVEF < 30%), underwent FDG SPECT (to assess glucose utilization), early thallium-201 SPECT (to assess perfusion) and resting echocardiography (to assess contractile status). All techniques were analyzed using a 13 segment model. Dysfunctional segments showing either normal perfusion or hypoperfusion with increased FDG uptake were considered viable. LVEF was assessed before and 3 months after revascularization by echo and radionuclide ventriculography. The patients were divided into 2 groups: group A consisted of 14 patients with 3 or more viable segments on FDG SPECT and group B consisted of 8 patients with 2 or less viable, dysfunctional segments. In group A the LVEF improved significantly from 25 ± 6% to 32 ± 6% (P < 0.01). Conversely, in group B the LVEF remained unchanged (24 ± 6% vs 25 ± 6%, NS). Considering an improvement of LVEF >5% significant, FDG SPECT correctly identified 12/12 (100%) of group A patients with viable myocardium, whereas 8/10 (80%) group B patients without viability were predicted. This study shows that FDG SPECT can identify patients who improve in global LV function after revascularization.

789 Exercise Functional Capacity and the Effect of Training in Patients With Coronary Artery Disease

Wednesday, March 19, 1997, 10:30 a.m.–Noon
Anaheim Convention Center, Room A19

10:30

789-1 Effect of Exercise Training in Post-MI Heart Failure: One Year Follow-up with Magnetic Resonance Imaging (MRI)

U. Goebbels, G. Dziekan, J. Myers, P. Dubach, W.H. Reinhart, R. Ratti, J. Bremerich [1], P. Buser [1], P. Müller. [1] *Kantonsspitäler Chur and Basel, Switzerland, Palo Alto DVAMC and Stanford University, Stanford, CA, USA*

Exercise training is now an accepted therapeutic intervention in patients with chronic heart failure (CHF). However, long-term follow-up of controlled exercise trials have not been performed. We followed 25 patients with CHF due to CAD that had been randomized to an intensive two month exercise training program or a control group (control group: n = 12, age 55 ± 7 years, EF 33.3 ± 6%; *exercise group:* n = 13, age 56 ± 5 years, EF 31.5 ± 7%). In the one year follow-up period, both groups were encouraged to perform regular exercise, but no formal program was imposed. Two patients in the control group experienced cardiac decompensation requiring hospitalization, and one patient in the exercise group died suddenly. At one year however, the remaining 24 patients were stable. Changes in oxygen uptake at maximal exercise (VO2 max, ml/kg/min), and at the lactate threshold (VO2 Lt, ml/kg/min), and left ventricular end-diastolic volume (LVEDV, ml) determined by MRI before and after the training period and at the one year follow-up were as follows:

	Exercise Group			Control Group		
	pre	post	1 year	pre	post	1 year
VO_2 max	19.7 ± 3	23.9 ± 4.8*	24.2 ± 4.6	18.8 ± 3.9	20.0 ± 4.3	19.4 ± 6.7
VO_2 Lt	13.6 ± 2.6	18.9 ± 2.2**	17.6 ± 3.8	13.7 ± 2.9	11.8 ± 2.0	14.8 ± 3.8
LVEDV	184.7 ± 47	192.4 ± 40	195.4 ± 38	179.8 ± 52	180.5 ± 51	190.5 ± 52

*$p < 0.05$ within group; **$p < 0.001$ within and between groups

Intensive exercise training in patients with CHF results in a significant improvement in VO2 max acutely, and this improvement is sustained over one year. Measures of ventricular volumes and function by MRI at one year demonstrated no adverse effects due to exercise training. Control patients showed no improvement in exercise capacity over the follow-up period, and also demonstrated no deterioration or improvement in MRI measures of volume or function.

10:45

789-2 Differential Effects on Peak Oxygen Consumption and Anaerobic Threshold during High- versus Low-Frequency Exercise Training in Patients with Coronary Artery Disease

W. Nieuwland, M.A. Berkhuysen, D.J. van Veldhuisen, P. Rispens, K.I. Lie. *University Hospital Groningen, Netherlands*

Although a wide variation of exercise training programs are applied during cardiac rehabilitation (CR), little is known about the relationship between exercise volume (time and intensity) and outcome. We therefore randomized patients with coronary artery disease either to a high-frequency (10 exercise sessions a week) or a low-frequency (2 exercise sessions a week) exercise training program during 6 weeks CR (duration of each session was 1 ½ hour).

130 Patients (114 men, 16 women; mean age 52.4 ± 9.3) were included after a recent coronary event (75% myocardial infarction, 9% coronary angioplasty; 10% unstable angina). In both programs the change in exercise capacity was highly significant ($p < 0.001$) (*full-time:* peak oxygen consumption [VO_2] = +14.0%, peak workload [W] = +17.0%, anaerobic threshold [AT] = +31.6%; *part-time: peak* VO_2 = +13.7%, *peak* W = +14.6%, AT = +10.0%). *Peak* W and AT increased significantly more during the full-time program (respectively, $p = 0.030$; $p < 0.001$), while there were no significant differences in increase of *peak* VO_2 between both programs.

High-frequency exercise training increases exercise capacity more than low-frequency exercise training. This holds especially for exercise capacity measured as *peak* W and AT, but less when measured as peak VO_2. It may be speculated that this would imply a physiological improvement during daily life; its clinical relevance is unknown and requires further study.

11:00

789-3 Spontaneous Changes in Exercise Capacity Following MI and CABG: Reduced vs. Preserved LV Function

G. Dziekan, U. Goebbels, J. Myers, P. Dubach, R. Ratti, W.H. Reinhart, P. Müller, M. Kuhn. *Kantonsspital Chur, Switzerland, Palo Alto DVAMC and Stanford University, Stanford, CA, USA*

The decrement in exercise capacity secondary to deconditioning and the left ventricular stunning associated with MI or CABG spontaneously improves post event. However, the impact of the status of the left ventricle on these improvements is unknown. Sixty seven patients one month after MI or CABG were randomized to a training (n = 34, age 59 ± 7) or a control group (n = 33, age 55 ± 6) and were followed over an additional one month period. Forty two patients had an EP > 55% (22 in the training group (Ex), 20 in the control group (Co)), and 25 patients had an EF < 40% (12 Ex, 13 Co). Below, cardiopulmonary exercise test results are stratified according to normal or reduced left ventricular (LV) function; maximal oxygen uptake (VO2 max) and oxygen uptake at the lactate threshold (VO2 Lt) are expressed in ml/kg/min:

		Pre		Post	
		Ex	Co	Ex	Co
VO_2 Lt	normal LV	15.4 ± 5	13.2 ± 3	17.2 ± 3	15.0 ± 3
	reduced LV	13.6 ± 3	13.7 ± 3	18.9 ± 2**	11.8 ± 2
VO_2 max	normal LV	22.6 ± 4	21.0 ± 4	26.4 ± 5**	25.0 ± 3**
	reduced LV	19.4 ± 3	18.8 ± 4	25.1 ± 5*	19.1 ± 4

*$p < 0.05$ pre vs. post within group, **$p < 0.05$ pre vs. post between normal LV and reduced LV

Control patients in the normal LV group showed progressive improvements in exercise capacity during the three month follow-up, whereas control patients in the reduced LV group remained unchanged. These data suggest that patients with severely depressed LV function strongly benefit from rehabilitation, whereas most patients with preserved LV function following MI or CABG improve spontaneously.

11:15

789-4 Effects of Training on The Recovery of Autonomic Nerve Activity During Exercise After Coronary Artery Bypass Surgery

H. Itoh, J. Takeyama [1], E. Yanagisawa, M. Kato, K. Sagara, L.-T. Fu, H. Watanabe, K. Kato, M. Nagayama [1], T. Katagiri [1]. *The Cardiovascular Institute, Tokyo, Japan,* [1] *Third Department Internal Medicine, Showa University, Tokyo, Japan*

Parasympathetic nerve activity (PNA) is suppressed and sympathetic nerve activity (SNA) is augmented after coronary artery bypass graft (CABG). To determine the effects of aerobic exercise training on the recovery in PNA and SNA during exercise after CABG, 28 patients (age: 60.4 ± 7.8 years. No. of grafts: 2.6 ± 0.7) were randomly divided into the training (T) group who started two-week AT level exercise training by a cycle ergometer at one week after CABG and the control (C) group who did non-supervised walking exercise for 2 weeks. They performed cardiopulmonary exercise tests using a cycle ergometer at 1 week, 3 weeks, 3 months, 6 months and 1 year after surgery. The heart rate variability was measured during 20 w steady-state pedaling and high frequency of power spectrum (HF; 0.15–0.6 Hz) was employed as an index of PNA. Norepinephrine level (NE) and cardiac output (CO) by the dye dilution method were also measured. NE at 20 w decreased from 1 to 3 weeks after surgery in both groups (by 0.39 ng/ml in T, 0.40 ng/ml in C). Peak VO_2 increased in both groups (by 2.7 ml/min/kg in T, 1.0 in C), but delta values were larger in the T group than the C group throughout the